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## Description

### Background of the Invention

**[0001]** The present invention relates to an artificial spinal disc prosthesis to replace a damaged or degenerated spinal disc.

**[0002]** A known spinal disc prosthesis is disclosed in U.S. Patent No. 3,867,728. U.S. Patent 3,867,728 discloses a spinal disc prosthesis which in one form comprises a single piece of elastomer molded to have a concave outer peripheral surface. The elastomer is interposed between and adhered to two outer covering elements. The concave outer peripheral surface extends from one of the covering elements to the other of the covering elements. When a bending moment is applied to the spinal disc prosthesis, the concave peripheral surface of the elastomeric core is stretched along one side. Stresses induced in the disc prosthesis, due to the stretching of the one side of the elastomeric core, are greatest at the interfaces between the elastomeric core and the two covering elements. Therefore, the covering elements could possibly separate from the elastomeric core.

**[0003]** U.S. Patent No. 5,071,437 discloses a spinal disc prosthesis comprising an upper flat rigid plate, a lower flat rigid plate and a flat elastomeric core interposed between the plates and adhered to the plates. A porous coating is provided on the plates adjacent to the elastomeric core to secure the plates to the elastomeric core. When a crack forms between one of the plates and the elastomeric core, the crack may propagate across the interface between the plate and the elastomeric core causing the plate to separate from the elastomeric core.

### Summary of the Invention

**[0004]** The present invention provides a new and improved spinal disc prosthesis to replace a damaged spinal disc. The spinal disc prosthesis of the present invention comprises an upper rigid plate, a lower rigid plate, and an elastomeric core interposed between the plates and adhered to the plates. The elastomeric core has an upper portion extending from the upper plate. The upper portion of the elastomeric core has an outer peripheral surface extending substantially perpendicular to the upper plate. A lower portion of the elastomeric core extends from the lower plate and has an outer peripheral surface extending substantially perpendicular to the lower plate. An intermediate portion of the core extends between the upper and lower portions and has a concave outer peripheral surface. When a bending moment and/or a translational force is applied to the spinal disc prosthesis, the stresses due to the stretching of one side of the concave surface are reduced at the intersection of the plates and core compared to a core having straight peripheral sides. The concave outer peripheral surface intersects the outer peripheral surfaces of the upper and lower portions of the core in the body of the core and not at the interfaces of the core with the upper and lower plates. Thus, the upper and lower plates have less tendency to separate from the elastomeric core.

**[0005]** Each of the upper and lower plates includes at least one rib extending into (embedded in) and adhered to the elastomeric core. Preferably, each of the plates includes a plurality of concentric ribs extending into the core that have substantially the same shape as an outer peripheral surface of the plates. Thus, the ribs on a plate are concentric with the outer peripheral surface of the plate. The ribs also reduce the tendency of the plates and core to separate. For example, if a crack is formed between one of the plates and the core, the crack, if it propagates across the interface between the plate and core, must change direction upon reaching a rib. This further minimizes the possibility of separation of the plate and the core.

### Brief Description of the Drawings

**[0006]** The foregoing and other features of the present invention will become more apparent to one skilled in the art upon reading the following description of a preferred embodiment with reference to the accompanying drawings, wherein:

Fig. 1 is an elevation view of a human spinal column having an artificial disc in accordance with that of the present invention placed therein;
Fig. 2 is a perspective view of the artificial spinal disc of Fig. 1;
Fig. 3 on the same sheet of drawings as Fig. 7 is an elevational view of the spinal disc of Fig. 2;
Fig. 4 is a plan view of a plate which is a part of the spinal disc of Fig. 3;
Fig. 5 is a sectional view of the plate of Fig. 4 taken along the line 5-5 of Fig. 4;
Fig. 6 is an enlarged sectional view of a portion of the plate of Fig. 5; and
Fig. 7 (on the second sheet of drawings) is a plan view of the bottom of the plate of Fig. 4.

### Description of Preferred Embodiment

**[0007]** A spinal disc prosthesis 5 (Fig. 1) is located between upper and lower vertebrae 6, 7 of a human spine. The disc 5 comprises an upper rigid plate 12, a lower rigid plate 14, and an elastomeric core 16 interposed between the two rigid plates 12, 14 and adhered to the two plates (Figs. 2 and 3). The upper plate 12 includes a surface 22 (Fig. 3) adhered to the core 16 and the lower plate 14 includes a surface 24 adhered to the core. The surface 22 of the plate 12 lies in a first plane which extends at an angle of approximately 3° to a second plane in which the surface 24 lies. Thus, the disc 5 and core 16 have a wedge shape. However, it is contemplated that the core 16 may be of uniform thick-

ness and thus the rigid plates 12 and 14 would be parallel to each other.

**[0008]** The core 16 comprises an upper portion 30 extending from the upper plate 12. The thickness of the upper portion 30 is substantially larger than the thickness of each of the plates 12, 14. The upper portion 30 has an outer peripheral surface 32 extending substantially perpendicular to the upper plate 12. The core 16 also includes a lower portion 34 with a thickness substantially larger than the thickness of each of the plates 12, 14 and equal to the thickness of the upper portion 30. The lower portion 34 of the core 16 has an outer peripheral surface 36 extending substantially perpendicular to the lower plate 14. An intermediate portion 38 of the core 16 extends between the upper portion 30 and the lower portion 34. The intermediate portion 38 has a concave outer peripheral surface 40.

**[0009]** Of the total thickness of the elastomeric core 16, the upper portion 30 is slightly less than 33% and about 31%, the lower portion 34 is also slightly less than 33% and about 31%, and the intermediate portion 38 is slightly more than 33% and about 38%. Also, since the core 16 is wedge shaped the lower portion 34, and the upper portion 30 are wedge shaped, i.e. vary in thickness as they extend from one side of the disc 5 to the other. The intermediate portion 38 is of substantially uniform thickness. Since the intermediate portion is of uniform thickness and the core 16 is wedge shaped, the intermediate portion is a greater percentage of the thickness of the core on the posterior side of the disc 5 than on the anterior side of the disc 5.

**[0010]** The plates 12 and 14 are identical and therefore only plate 12 will be described. The plate 12 is preferably kidney shaped in plan view with a curved convex side 46 (Fig. 4) and an opposed concave side 48. The configuration shown in Fig. 4 is designed to conform generally to the shape of a natural human spinal disc. The dimensions of the core 16 in plan view are identical to the dimensions of the plates 12 and 14 in plan view. Thus, the rigid plates 12 and 14 and core 16 completely overly each other, and the rigid plates 12 and 14 do not extend beyond the core 16 nor does the core 16 extend beyond the rigid plates 12, 14.

**[0011]** The plate 12 includes a plurality of concentric kidney shaped ribs 50, 51 and 52 (Figs. 5-7). Preferably, each of the plates 12, 14 includes three ribs 50, 51 and 52. The ribs 50, 51 and 52 are also concentric with the outer peripheral surface of the plate 12.

**[0012]** The rib 50 extends from the plate 12 near the outer peripheral surface of the plate. The rib 52 extends from the plate 12 relatively close to the center of the plate and the rib 51 extends from the plate in an area between ribs 50 and 52. The distance between the ribs 50 and 51 is equivalent to the distance between the ribs 51 and 52. The ribs 50, 51 and 52 extend into the core 16 and are adhered to the core to assist in securing the plates 12 and 14 to the core. A rib 54 (Fig. 5) on the outer periphery of plate 12 extends away from the core 16 and defines a recess 56 in the side of plate 12 opposite the side from which the ribs 50, 51 and 52 extend. The plate 12 includes a chamfer 60 along the outer periphery of the plate. The core 16 covers the chamfer 60 (shown in Fig. 6).

**[0013]** Both the upper and lower plates 12, 14 have, on their exposed faces, a plurality of conical projections 62 which are spaced apart and extend vertically outwardly from the plates. The projections 62 are adapted to fit within seats or depressions in the opposed vertebrae 6, 7. The projections 62 position the disc 5 relative to the vertebrae 6, 7 and function to maintain that position.

**[0014]** The recess 56 receives a porous coating 66. Also, the inner surface 22 of the plate is covered with porous coatings 68, 70, 72, and 74. The porous coating 68 lies between the rib 50 and the outer periphery of the plate 12. The porous coating 70 lies between ribs 50 and 51, and the porous coating 72 lies between ribs 51 and 52. The porous coating 74 lies within the rib 52 and is surrounded by the rib 52. The ribs 50, 51 and 52 are not covered by a porous coating.

**[0015]** The rib 54, defining the recess 56 for receiving the porous coating 66, extends outwardly from the plate 12 a distance slightly greater than the distance the porous coating 66 extends from the plate, see Figs. 5 and 6. The ribs 50, 51 and 52 extend from the plate 12 a distance substantially greater than the distance the porous coatings 68-74 extend from the plate. Thus, the ribs 50, 51 and 52 extend into the core 16 a substantial distance to secure the plates 12 and 14 to the core.

**[0016]** The porous coatings 66-74 comprise a layer of small spherical particles. The spherical particles are preferably made of commercially pure titanium, but could be made of any suitable biocompatible material. The spherical particles are sized such that none of the spherical particles pass through a 25 mesh U.S. Series Sieve and all the spherical particles pass through a 40 mesh U.S. Series Sieve. Particles can be applied to the plates by vapor deposition, by plasma jet spraying, by sintering or by any other suitable technique. The coatings 66-74 are firmly adhered to the plates 12, 14 and incapable of removal by normal abrasions. The porous coating 66 provides for ingrowth of tissue to cause the bone to more firmly attach to the plates 12, 14 than if the coating 66 was not present. The coatings 68-74 interlock with the material of the core 16 to provide a strong bond between the plates 12 and 14 and the core 16.

**[0017]** In a preferred embodiment of the present invention, the elastomeric core is made of a composite of 70% by weight of H.P. 100 4099 silicone elastomer and 30% by weight of H.P. 100 4106 silicone elastomer, both manufactured by Dow Corning. The hardness of the H. P. 100 4099 elastomer is between 52 and 60 and the hardness of the H.P. 100 4106 elastomer is between 65 and 75 using the ASTM D2240-86 testing method. The ultimate tensile strength of the H.P. 100 4099 elastomer

is greater than 7.585 N/mm$^2$ (1100 psi) and the ultimate tensile strength of the H.P. 100 4106 elastomer is greater than 6.895 N/mm$^2$ (1,000 psi) and each of the silicone elastomers has an ultimate elongation greater than 500% using the ASTM D412-87 testing method. Each of the silicone elastomers has a tear resistance greater than 43.8 N/mm (250 ppi) using the ASTM D624-86 testing method. Although the elastomeric core 16 is disclosed as being made of a composite of H.P. 100 4099 and H.P. 100 4106 it can be made of any elastomeric material that provides the characteristics of a natural disc.

**[0018]** The plates 12 and 14 are preferably made of a biocompatible metal such as a titanium-vanadium-aluminum alloy having about 90% by weight titanium; about 6% by weight aluminum and about 4% by weight vanadium. Although the plates 12, 14 are disclosed as being made out of a titanium-vanadium-aluminum alloy they can be made out of any suitable biocompatible material including but not limited to a composite plastic material and the like.

**[0019]** The plates 12 and 14 are milled out of a block of metal. However, the plates 12 and 14 could be otherwise manufactured, for example, they could be cast. The spherical particles forming the porous coatings 66-74 are placed on the plates and preferably sintered to the plates 12 and 14 by placing the plate with the particles in place in a heated oven to secure the particles to the plates.

**[0020]** To construct the prosthesis 5, the plates 12 and 14, with the coatings 66-74 in place, are cleaned in a methyl ethyl ketone or similar reagent bath for approximately 25 minutes. The plates are then cleaned with an alkaline cleaning solution and rinsed in distilled water. Then they are dipped in an acid solution such as sulfuric acid pickling solution and rinsed in distilled water. Then the plates are etched for example with a nitric hydrofluoric acid solution to remove any oxide coating from the plates. They are then rinsed in distilled water, and a primer such as about a 5% solution of DC-1107 in heptane/methylene chloride is applied to all surfaces of the plates that will be bonded to the core 16. The primer is applied within about 2 hours. The DC-1107 is manufactured by Dow Corning. The plates are then placed in a mold and the elastomeric material is flowed into the mold and adhered to the ribs 50, 51, 52 and coatings 68, 70, 72, 74. The elastomer is then cured.

**[0021]** When a bending moment and/or a translational force is applied to the spinal disc 5, the stresses due to the stretching of one side of the concave surface 40 are reduced at the intersection between the core and plates compared to a straight sided peripheral core. Thus, the plates have less tendency to separate from the elastomeric core.

**[0022]** Also, if a crack is formed between one of the plates 12, 14 and the core 16, the crack must change direction upon reaching one of the ribs 50, 51 and 52 if the crack propagates across the interface between the plate and the core. Such a change in direction is less likely to occur than the crack continuing to propagate in the absence of the ribs. Therefore, the possibility of the plates 12, 14 separating from the core 16 is minimized.

**[0023]** From the above description of the invention, those skilled in the art will perceive improvements, changes and modifications. Such improvements, changes and modifications within the skill of the art are intended to be covered by the appended claims.

## Claims

1. A spinal disc prosthesis to replace a damaged spinal disc comprising:

   an upper rigid plate (12);
   a lower rigid plate (14); and
   an elastomeric core (16) interposed between said plates and adhered to said plates, said elastomeric core comprising an upper portion (30) extending from said upper plate, said upper portion of said core having an outer peripheral surface (32) extending substantially perpendicular to said upper plate, a lower portion (34) extending from said lower plate, said lower portion of said core having an outer peripheral surface (36) extending substantially perpendicular to said lower plate, characterized by an intermediate portion (38) extending between said upper and lower portions, said intermediate portion of said core having a concave outer peripheral surface (40).

2. A spinal disc prosthesis as defined in claim 1 wherein each of said upper and lower portions (30,34) of said core (16) has a thickness which is substantially larger than the thickness of each of said plates.

3. A spinal disc prosthesis as defined in claim 1 wherein said upper plate (12) has a lower side surface (22) lying in a first plane and said lower plate (14) has an upper side surface (24) lying in a second plane, said first plane extending at an angle to said second plane.

4. A spinal disc prosthesis as defined in claim 3 wherein said first plane extends at an angle of approximately 3° to said second plane.

5. A spinal disc prosthesis as defined in claim 1 wherein each of said plates (12,14) includes at least one rib (50,51,52) adhered to and extending into said elastomeric core (16).

6. A spinal disc prosthesis as defined in claim 5 wherein said rib (50,51,52) has substantially the same shape as an outer peripheral surface of said plate.

7. A spinal disc prosthesis as defined in claim 5 wherein each of said plates includes a plurality of ribs (50,51,52) extending into said elastomeric core (16).

8. A spinal disc prosthesis to replace a damaged spinal disc comprising:

an upper rigid plate (12);
a lower rigid plate (14);
an elastomeric core (16) interposed between said plates and adhered to said plates; characterized by
each of said upper and lower plates including at least one rib (50,51,52) adhered to and extending into said elastomeric core to resist separation of said plates and core.

9. A spinal disc prosthesis as defined in claim 8 wherein said rib (50,51,52) has substantially the same shape as an outer peripheral surface of said plate.

10. A spinal disc prosthesis as defined in claim 9 wherein said plate and said core (16) are kidney shaped.

11. A spinal disc prosthesis as defined in claim 8 wherein each of said plates (12,14) includes a plurality of ribs (50,51,52) adhered to and extending into said elastomeric core (16).

12. A spinal disc prosthesis as defined in claim 11 wherein said plurality of ribs (50,51,52) are concentric and have substantially the same shape as an outer peripheral surface of said plate.

13. A spinal disc prosthesis as defined in claim 8 wherein each of said plates (12,14) includes a rib (62) extending outwardly away from said elastomeric core (16), said outwardly extending rib defining a recess and a porous particle coating (66) on said plates and located in said recess.

14. A spinal disc prosthesis as defined in claim 8 wherein said elastomeric core (16) comprises an upper portion (30) extending from said upper plate, said upper portion of said core having an outer peripheral surface (32) extending substantially perpendicular to said upper plate, a lower portion (34) extending from said lower plate, said lower portion of said core having an outer peripheral surface (36) extending substantially perpendicular to said lower plate, and an intermediate portion (38) extending between said first and second portions, said intermediate portion having a concave outer peripheral surface (40).

15. A spinal disc prosthesis as defined in claim 14 wherein said upper portion (30) is about 31% of the thickness of said core, said lower portion (34) is about 31% of the thickness of said core, and said intermediate portion (38) is about 38% of the thickness of said core.

**Patentansprüche**

1. Bandscheiben-Prothese zum Ersatz einer beschädigten Bandscheibe, welche aufweist:

eine obere steife Platte (12);
eine untere steife Platte (14), und
einen elastomeren Kern (16), welcher zwischen den genannten Platten angeangeordnet ist und an diesen haftet, wobei der genannte elastomere Kern aufweist:

- einen oberen Teil (30), welcher sich von der gennannten oberen Platte weg erstreckt, wobei der genannte obere Teil des genannten Kerns eine äussere periphere Oberfläche (32), die sich im Wesentlichen senkrecht zur genannten oberen Platte erstreckt, aufweist;
- einen unteren Teil (34), welcher sich von der genannten unteren Platte weg erstreckt, wobei der genannte untere Teil des genannten Kerns eine äussere periphere Oberfläche (36), die sich im Wesentlichen senkrecht zur genannten unteren Platte erstreckt, aufweist,

**dadurch gekennzeichnet,** dass sie einen Zwischenteil (38) aufweist, welcher sich zwischen den genannten oberen und unteren Teilen erstreckt, wobei der genannte Zwischenteil des genannten Kerns eine konkave äussere periphere Oberfläche aufweist.

2. Bandscheiben-Prothese nach Anspruch 1, bei welcher jeder der genannten oberen und unteren Teile (30, 34) des genannten Kern (16) eine Dicke aufweist, welche wesentlich grösser ist als die Dicke jeder der beiden genannten Platten.

3. Bandscheiben-Prothese nach Anspruch 1, bei welcher die genannte obere Platte (12) eine untere seitliche Oberfläche (22) aufweist, welche in einer ersten Ebene liegt, und genannte untere Platte (14) eine untere seitliche Oberfläche (24) aufweist, welche in einer zweiten Ebene liegt, wobei die genannte erste Ebene sich in einem Winkel zur genannten zweiten Ebene erstreckt.

4. Bandscheiben-Prothese nach Anspruch 3, bei welcher die genannte erste Ebene in einem Winkel von angenähert 3° zur genannten zweiten Ebene er-

streckt.

5. Bandscheiben-Prothese nach Anspruch 1, bei welcher jeder der genannten Platten (12, 14) mindestens eine Rippe (50, 51, 52) aufweist, welche an dem genannten elastomeren Kern (16) haftet und sich in diesen hinein erstreckt.

6. Bandscheiben-Prothese nach Anspruch 5, bei welcher die genannte Rippe (50, 51, 52) im Wesentlichen dieselbe Form aufweist wie eine äussere periphere Oberfläche der genannten Platte.

7. Bandscheiben-Prothese nach Anspruch 5, bei welcher jeder der genannten Platten eine Mehrzahl von Rippen (50, 51, 52) aufweist, welche sich in den genannten elastomeren Kern (16) hinein erstrecken.

8. Bandscheiben-Prothese zum Ersatz einer beschädigten Bandscheibe, welche aufweist:

eine obere steife Platte (12);
eine untere steife Platte (14);
einen elastomeren Kern (16), welcher zwischen den genannten Platten angeordnet ist und an diesen haftet,

**dadurch gekennzeichnet,** dass jede der genannten mindestens eine Rippe (50, 51, 52) aufweist, welche am genannten elastomeren Kern haften und sich in diesen hinein erstrecken, um einer Trennung zwischen den genannten Platten und dem Kern zu widerstehen.

9. Bandscheiben-Prothese nach Anspruch 8, bei welcher die genannte Rippe (50, 51, 52) im Wesentlichen dieselbe Form aufweist wie eine äussere periphere Oberfläche der genannten Platte.

10. Bandscheiben-Prothese nach Anspruch 9, bei welcher die genannte Platte und der genannte Kern (16) nierenförmig ausgebildet sind.

11. Bandscheiben-Prothese nach Anspruch 8, bei welcher jede der genannten Platten (12, 14) eine Mehrzahl von Rippen (50, 51, 52) aufweist, welche am genannten elastomeren Kern (16) haften und sich in diesen hinein erstrecken.

12. Bandscheiben-Prothese nach Anspruch 11, bei welcher die genannte Mehrzahl von Rippen (50, 51, 52) konzentrisch angeordnet sind und im Wesentlichen dieselbe Form aufweist wie eine äussere periphere Oberfläche der genannten Platte.

13. Bandscheiben-Prothese nach Anspruch 8, bei welcher jede der genannten Platten (12, 14) aufweist:

- eine Rippe (62), welche sich vom genannten elastomeren Kern (16) weg nach aussen erstreckt, wobei die genannte sich nach aussen erstreckende Rippe eine Ausnehmung definiert, und
- einen Überzug (66) aus porösen Teilchen auf den genannten Platten, welche in der genannten Ausnehmung angeordnet ist.

14. Bandscheiben-Prothese nach Anspruch 8, bei welcher der genannte elastomere Kern (16) aufweist:

- einen oberen Teil (30), welcher sich von der genannten oberen Platte weg erstreckt, wobei der genannte obere Teil des genannten Kerns eine äussere periphere Oberfläche (32) aufweist, welche sich im Wesentlichen senkrecht zur genannten oberen Platte erstreckt;
- einen unteren Teil (34), welcher sich von der genannten unteren Platte weg erstreckt, wobei der genannte untere Teil des genannten Kerns eine äussere periphere Oberfläche (36) aufweist, welche sich im Wesentlichen senkrecht zur genannten unteren Platte erstreckt; und
- einen Zwischenteil (38), welcher sich zwischen den genannten ersten und zweiten Teilen erstreckt und eine konkave äussere periphere Oberfläche (40) aufweist.

15. Bandscheiben-Prothese nach Anspruch 14, bei welcher die Dicke des genannten oberen Teils (30) ungefähr 31 % derjenigen des genannten Kerns, die Dicke des genannten unteren Teils (34) ungefähr 31 % derjenigen des genannten Kerns, und die Dicke des genannten Zwischenteils (38) ungefähr 38 % derjenigen des genannten Kerns beträgt.

**Revendications**

1. Prothèse de disque intervertébral pour remplacer un disque intervertébral endommagé, comprenant :

une plaque supérieure rigide (12) ;
une plaque inférieure rigide (14) ; et
une âme en élastomère (16) interposée entre les dites plaques et collée aux dites plaques, la dite âme en élastomère comprenant une partie supérieure (30) qui s'étend à partir de la dite plaque supérieure, la dite partie supérieure de la dite âme ayant une surface périphérique extérieure (32) qui est sensiblement perpendiculaire à la dite plaque supérieure, une partie inférieure (34) qui s'étend à partir de la dite plaque inférieure, la dite partie inférieure de la dite âme ayant une surface périphérique extérieure (36) qui est sensiblement perpendiculaire à la dite plaque inférieure, **caractérisée en ce**

qu'une partie intermédiaire (38) s'étend entre les dites parties supérieure et inférieure, la dite partie intermédiaire de la dite âme ayant une surface périphérique extérieure concave (40).

2. Prothèse de disque intervertébral selon la revendication 1, dans laquelle chacune des dites parties supérieure et inférieure (30, 34) de la dite âme (16) a une épaisseur qui est sensiblement plus grande que l'épaisseur de chacune des dites plaques.

3. Prothèse de disque intervertébral selon la revendication 1, dans laquelle la dite plaque supérieure (12) présente une surface du côté inférieur (22) située dans un premier plan et la dite plaque inférieure (14) présente une surface du côté supérieur (24) située dans un deuxième plan, le dit premier plan formant un angle avec le dit deuxième plan.

4. Prothèse de disque intervertébral selon la revendication 3, dans laquelle le dit premier plan forme un angle de 3° environ avec le dit deuxième plan.

5. Prothèse de disque intervertébral selon la revendication 1, dans laquelle chacune des dites plaques (12, 14) comporte au moins une nervure (50, 51, 52) collée à la dite âme en élastomère (16) et pénétrant dans celle-ci.

6. Prothèse de disque intervertébral selon la revendication 5, dans laquelle la dite nervure (50, 51, 52) a sensiblement la même forme qu'une surface périphérique extérieure de la dite plaque.

7. Prothèse de disque intervertébral selon la revendication 5, dans laquelle chacune des dites plaques comporte une pluralité de nervures (50, 51, 52) pénétrant dans la dite âme en élastomère (16).

8. Prothèse de disque intervertébral pour remplacer un disque intervertébral endommagé, comprenant :

une plaque supérieure rigide (12) ;
une plaque inférieure rigide (14) ;
une âme en élastomère (16) interposée entre les dites plaques et collée aux dites plaques ;

**caractérisée en ce que**

chacune des dites plaques supérieure et inférieure comporte au moins une nervure (50, 51, 52) collée à la dite âme en élastomère et pénétrant dans celle-ci pour s'opposer à la séparation des dites plaques et de l'âme.

9. Prothèse de disque intervertébral selon la revendication 8, dans laquelle la dite nervure (50, 51, 52) a sensiblement la même forme qu'une surface périphérique extérieure de la dite plaque.

10. Prothèse de disque intervertébral selon la revendication 9, dans laquelle la dite plaque et la dite âme (16) sont en forme de haricot.

11. Prothèse de disque intervertébral selon la revendication 8, dans laquelle chacune des dites plaques (12, 14) comporte une pluralité de nervures (50, 51, 52) collées à la dite âme en élastomère (16) et pénétrant dans celle-ci.

12. Prothèse de disque intervertébral selon la revendication 11, dans laquelle la dite pluralité de nervures (50, 51, 52) sont concentriques et ont sensiblement la même forme qu'une surface périphérique extérieure de la dite plaque.

13. Prothèse de disque intervertébral selon la revendication 8, dans laquelle chacune des dites plaques (12, 14) comporte une nervure (62) s'étendant vers l'extérieur à l'opposé de la dite âme en élastomère (16), la dite nervure s'étendant vers l'extérieur définissant un creux, et un revêtement de particules poreux (66) appliqué sur les dites plaques et placé dans le dit creux.

14. Prothèse de disque intervertébral selon la revendication 8, dans laquelle la dite âme en élastomère (16) comprend une partie supérieure (30) qui s'étend à partir de la dite plaque supérieure, la dite partie supérieure de la dite âme ayant une surface périphérique extérieure (32) qui est sensiblement perpendiculaire à la dite plaque supérieure, une partie inférieure (34) qui s'étend à partir de la dite plaque inférieure, la dite partie inférieure de la dite âme ayant une surface périphérique extérieure (36) qui est sensiblement perpendiculaire à la dite plaque inférieure, et une partie intermédiaire (38) qui s'étend entre les dites première et deuxième parties, la dite partie intermédiaire ayant une surface périphérique extérieure concave (40).

15. Prothèse de disque intervertébral selon la revendication 14, dans laquelle la dite partie supérieure (30) représente environ 31% de l'épaisseur de la dite âme, la dite partie inférieure (34) représente environ 31% de l'épaisseur de la dite âme, et la dite partie intermédiaire (38) représente environ 38% de l'épaisseur de la dite âme.

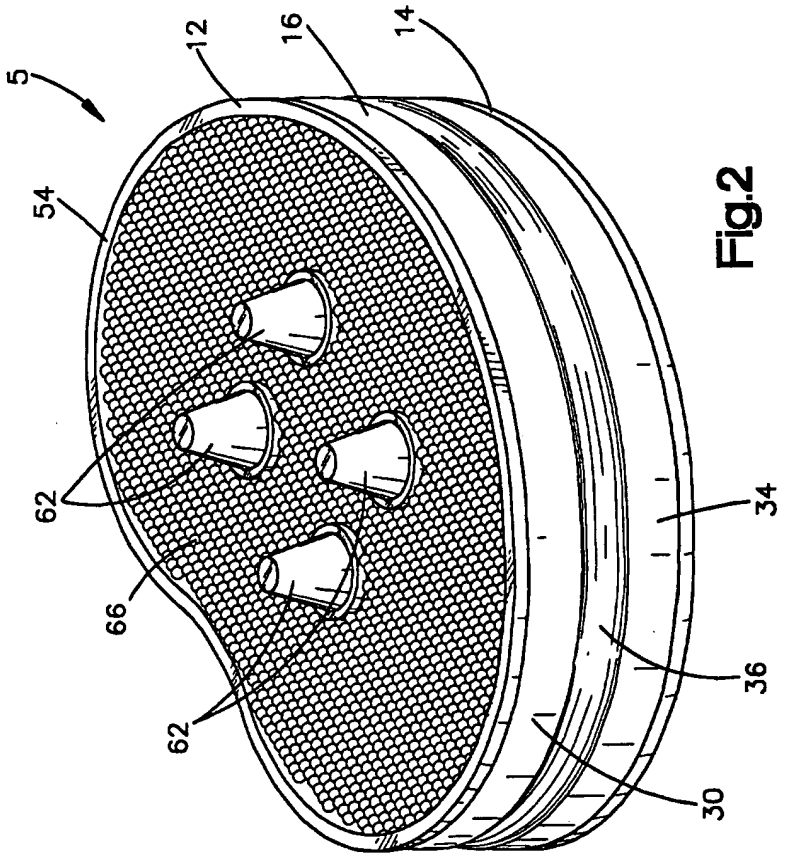


Fig.2

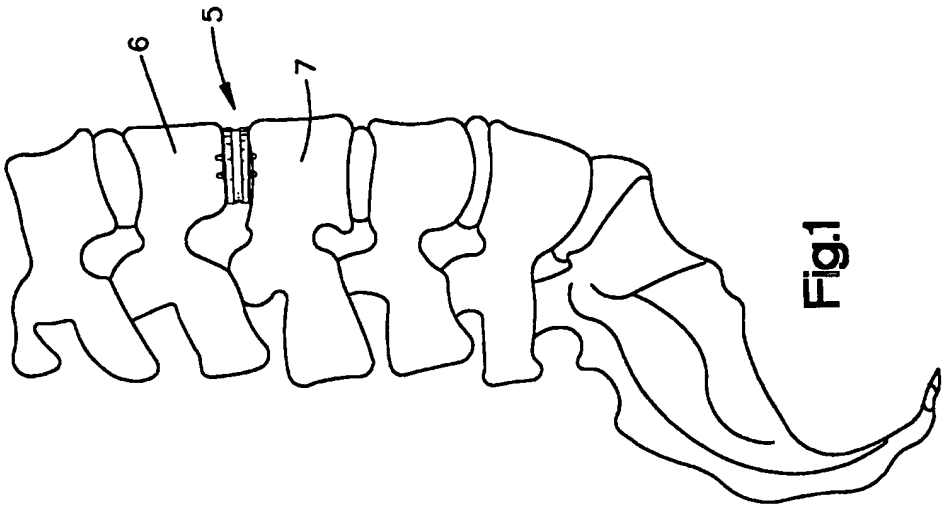


Fig.1

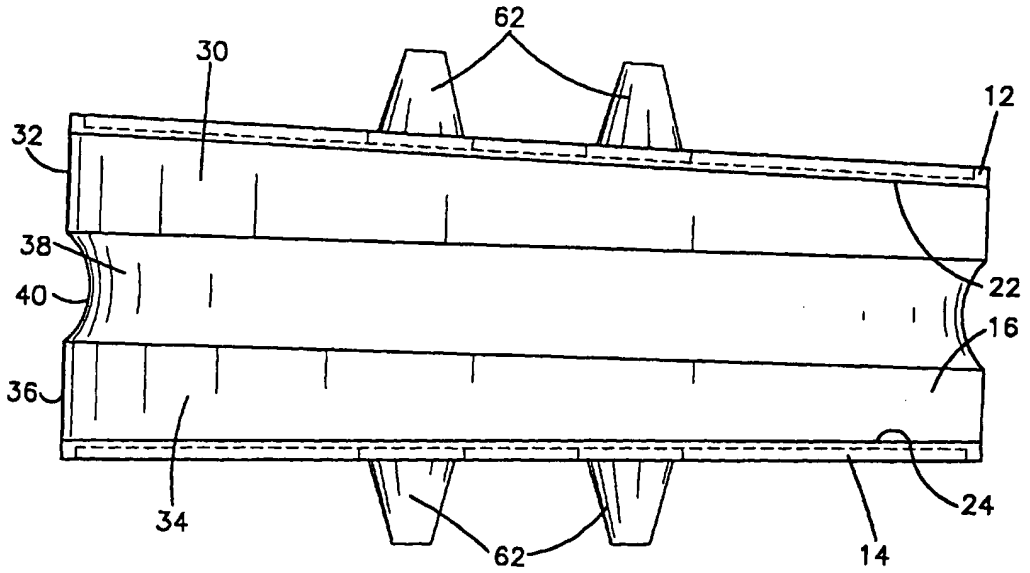


Fig.3

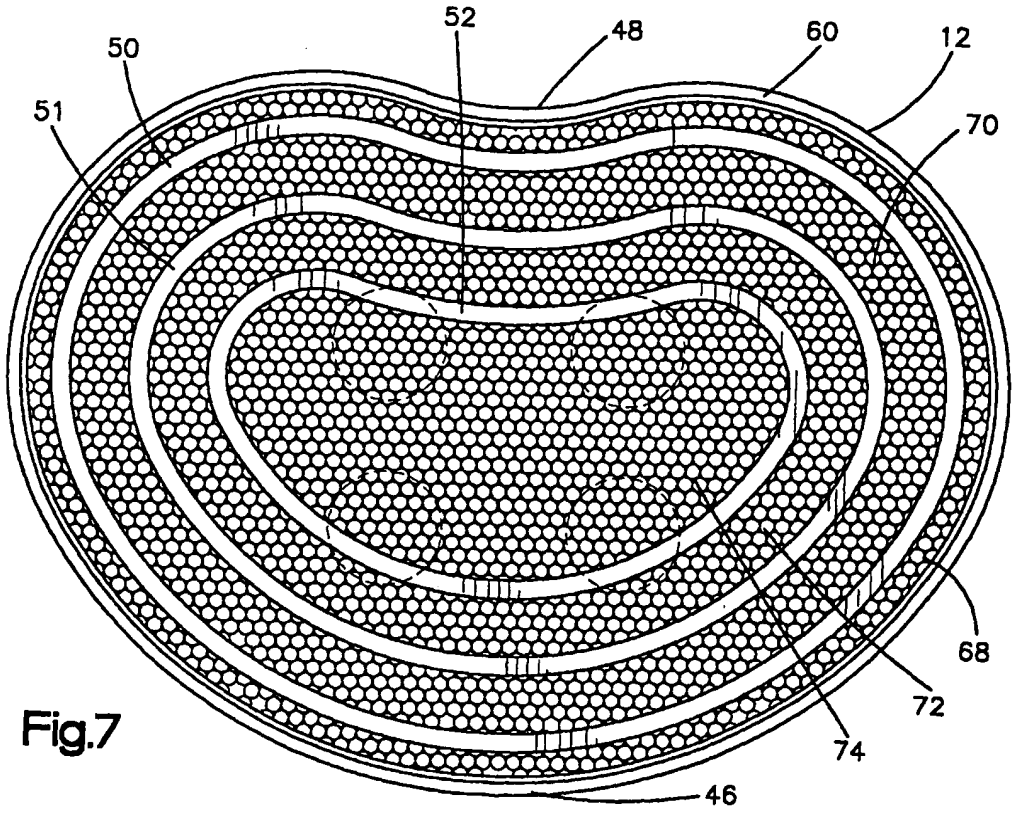


Fig.7

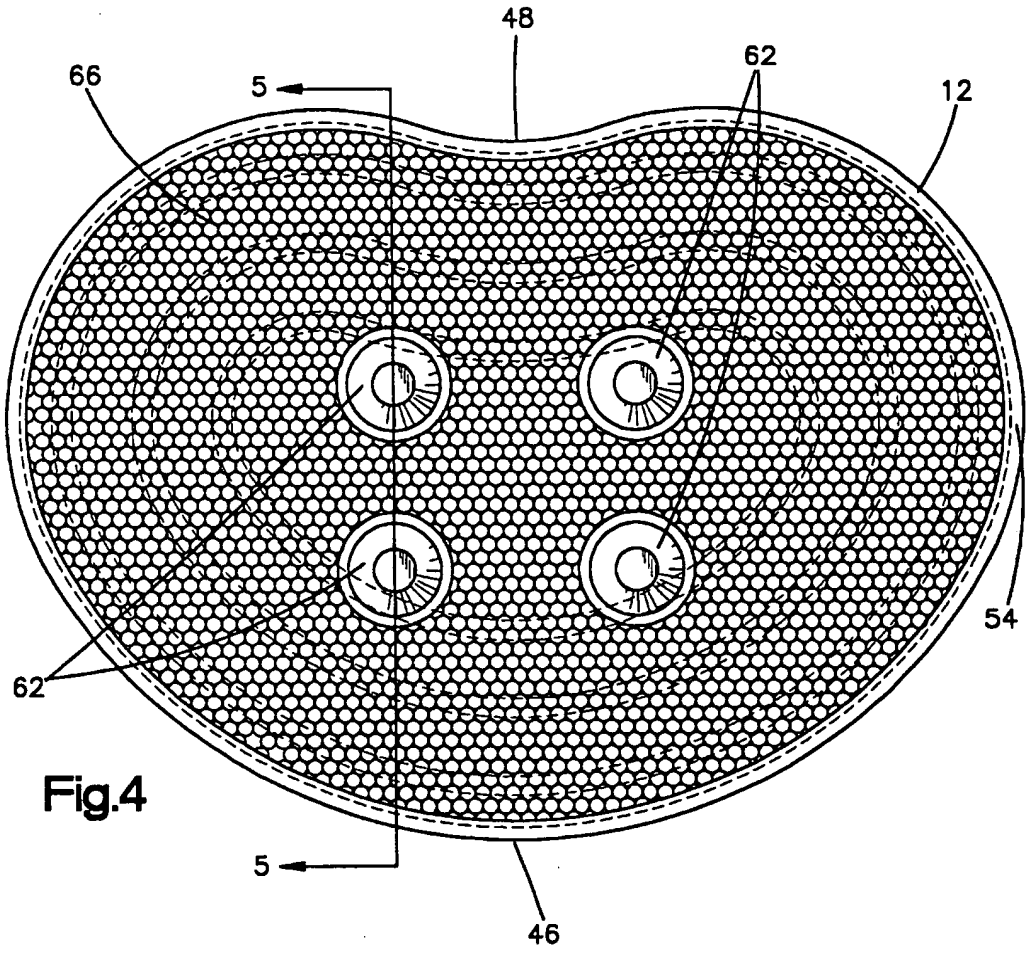


Fig.4

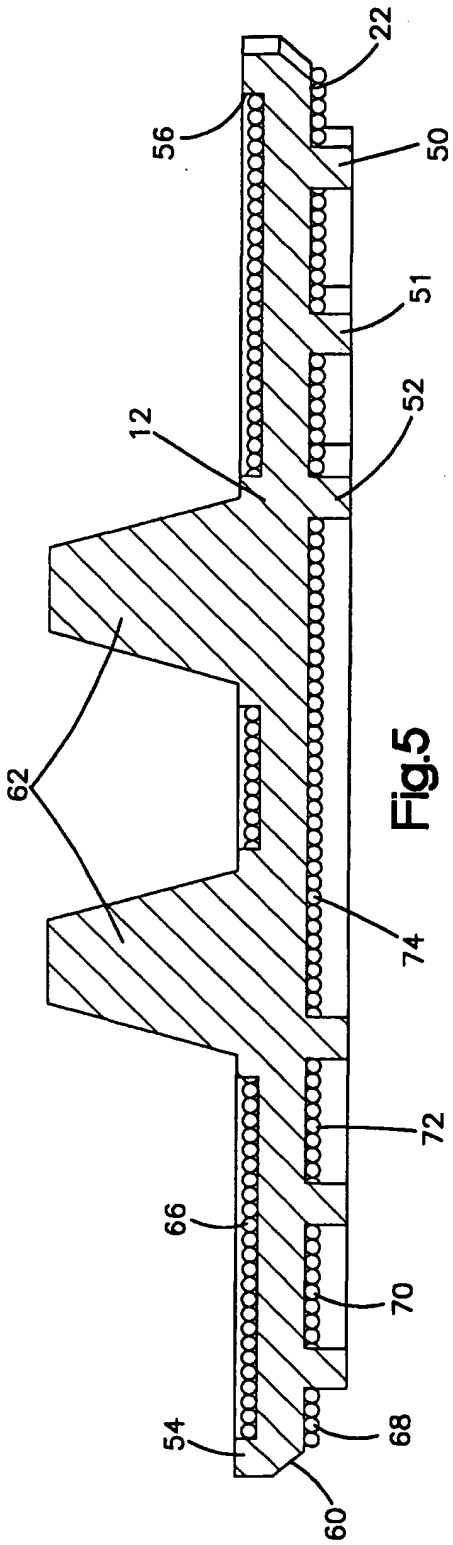


Fig.5

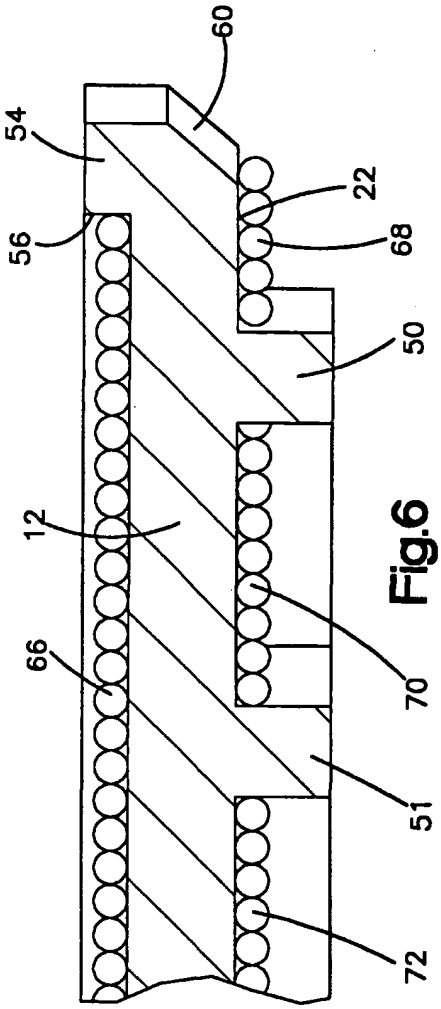


Fig.6